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Operations and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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Operations and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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ASSIGNMENT PAGE

Operations and Maintenance Plan
for the
Northwest Plume Groundwater System
Interim Remedial Action
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky
(DOE/OR/07-1253&D4)

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ABBREVIATIONS

^{99}Tc	technetium-99
ACO	Administrative Consent Order
CMP	Configuration Management Plan
DM	Data Management
DMC	Document Management Center
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U. S. Environmental Protection Agency
EQ	equalization
ER	Environmental Restoration
EW	extraction well
HSP	Health and Safety Plan
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
LMES	Lockheed Martin Energy Systems, Inc.
LMUS	Lockheed Martin Utility Services, Inc.
MW	monitoring well
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NW	Northwest
NWPGS	Northwest Plume Groundwater System
O&M	Operations and Maintenance
PGDP	Paducah Gaseous Diffusion Plant
PLC	programmable logic controller
ppb	parts per billion
PPE	personal protective equipment
QA	quality assurance
QA/DM	Quality Assurance/Data Management
QC	quality control
ROD	Record of Decision
SSHO	Site Safety and Health Officer
TCE	trichloroethylene

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EXECUTIVE SUMMARY

The Operations and Maintenance (O&M) Plan has been prepared to serve as a guide and reference for the operations and maintenance of the Northwest Plume Groundwater System (NWPGS) constructed as an interim remedial action for the Northwest (NW) Plume of the Paducah Gaseous Diffusion Plant (PGDP), near Paducah, Kentucky. The interim remedial action is consistent with the U.S. Department of Energy (DOE) Environmental Restoration Division *Record of Decision* [ROD] *for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant,* that was signed in July 1993.

The purpose of the interim remedial action is to:

- recover and treat contaminated groundwater,
- determine the treatment efficiency of the system, and
- determine the effect of extraction on the Regional Gravel Aquifer.

The objective of this interim remedial action measure is to initiate control of the source of contamination and mitigate the spread of the highest trichloroethylene (TCE) concentration portion (greater than 1,000 μg/L) of the NW Plume.

In August 1988, volatile organic compounds and radionuclides were detected in private wells north of PGDP. In response, DOE and the U.S. Environmental Protection Agency (EPA) entered into an Administrative Consent Order (ACO) under Sects. 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act.

Pursuant to the ACO, Martin Marietta Energy Systems, Inc., conducted a site investigation to determine the nature and extent of contamination. It was concluded from the investigation that the principal contaminants of concern in the off-site groundwater are technetium-99 (^{99}Tc), a radionuclide, and TCE, an organic solvent.

The ROD of July 1993 initiated an interim remedial measure that included construction of a pilot plant to be operated for 2 years to determine the effectiveness of the remedial action. Evaluation of the effectiveness of the interim action is ongoing. The focus of the first 2 years of operation was to determine the feasibility of containing the high TCE concentration portion of the NW Plume, whether extracted groundwater could be effectively treated, and gather data to refine estimated operating costs. The focus of current operations is to control the contamination and mitigate the spread of the highest TCE concentration portion of the NW Plume through groundwater extraction. Data collection for the NWPGS will continue in order to provide a means of evaluating the cost effectiveness, as well as the remedial effectiveness, of the system.

The NWPGS consists of four extraction wells in two well fields; a groundwater treatment system, including an air stripper with treatment for off-gas emissions; and four ion exchange units configured in two parallel trains. To evaluate the effectiveness of the remedial action, wells are being monitored at various locations.

The NWPGS treatment goals, as specified in the ROD, are 5 ppb for TCE and 900 pCi/L for ^{99}Tc. These values for TCE and ^{99}Tc are set as project-specific goals (not regulatory levels) for the effluent before discharge; these values are not goals or regulatory levels for aquifer cleanup. The

system effluent discharges to Kentucky Pollutant Discharge Elimination System–permitted Outfall 001. The NWPGS also includes an on-site laboratory to perform sample analyses.

This O&M Plan provides an overview of background information, reporting requirements, O&M responsibilities, and procedures/work instructions. It also identifies necessary plans and procedures/work instructions required to ensure compliance with DOE, EPA, and Kentucky Department for Environmental Protection (KDEP) policies and laws. Specific training requirements and PGDP emergency response and specific operating procedures/work instructions are also identified.

An initial draft (D1) of the O&M Plan was provided to KDEP and EPA in May 1994. Comments on the D1 version were addressed and revisions were included in the second draft (D2). The D2 was reviewed by KDEP and EPA and concurrence was provided, which allowed the pilot plant to begin operations. The D3 incorporated comments from review of the draft, D2, and modifications resulting from final construction, startup, and testing. This D4 version was written using the Federal Facilities Agreement outline and is streamlined to serve as a guide for locating plans and procedures/work instructions associated with operation and maintenance of the NWPGS. The D4 includes changes resulting from 2 years of pilot operation. It is expected that additional changes will be necessary in the future as ways to improve system performance and efficiency are identified. To facilitate anticipated future changes, the D4 version of the O&M Plan will be issued as a controlled document and all changes will be provided to the assigned document holder using transmittal sheets.

1. EQUIPMENT STARTUP AND OPERATOR TRAINING

1.1 GENERAL NORTHWEST PLUME GROUNDWATER SYSTEM DESCRIPTION

The Northwest Plume Groundwater System (NWPGS) is a groundwater treatment facility located at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. The groundwater treatment system is housed in a pre-engineered metal building located outside the northwest corner of the PGDP security fence. The NWPGS is designed to recover and treat contaminated groundwater, to generate data to determine the treatment efficiency for the extracted groundwater, and to evaluate the effect of extraction on the Regional Gravel Aquifer.

The primary objective of this interim remedial action is to initiate control of the contamination and mitigate the spread of the highest trichloroethylene (TCE) concentration portion (greater than 1,000 μg/L) of the Northwest (NW) Plume. The purpose of this Operations and Maintenance (O&M) Plan is to provide information on operation of the NWPGS and on-site laboratory, and to provide data management and reporting requirements to assist Environmental Restoration (ER) Program personnel in evaluating the effectiveness of the interim remedial action.

The groundwater recovery system includes two wells in a south extraction well field at the PGDP security fence and two wells in a north extraction well field at the north end of the 1,000 parts per billion (ppb) TCE plume. The extracted groundwater is transferred through secondary containment dual wall piping to the treatment facility. The treatment system is designed to remove TCE and technetium-99 (^{99}Tc) using air stripping and ion exchange technologies. The treated groundwater is discharged to a permitted outfall. The approximate location of the well fields and the treatment plant is illustrated in Fig. 1.1. This interim remedial action, in combination with future remedial actions for the groundwater, should contain the source area and reduce the highest concentrations in the dissolved phase of the plume (DOE 1993a).

1.2 INITIAL PILOT PLANT STARTUP GUIDELINES

The initial startup phases for the pilot plant have been completed and the system is now in a normal O&M phase. An Integrated Test Plan was conducted in July 1995 and Shakedown Operations were conducted in August 1995. Normal O&M began on August 28, 1995.

1.3 OPERATOR TRAINING

Personnel training activities regarding procedures/work instructions were completed and documented during the system startup period. New personnel will be required to complete training pertaining to procedures/work instructions before performing work at the NWPGS. General training requirements regarding health and safety and PGDP requirements for work on-site are listed in the NWPGS Health and Safety Plan (HSP) provided as Appendix A, and the *Northwest Plume Pilot Plant and Northeast Plume Containment System, Operations & Maintenance, Quality Assurance and Data Management Plan* [QA/DM Plan] (LMES 1997a). All training requirements are outlined in the NWPGS Reference Manual in the "NWPGS/NEPCS Training Matrix."

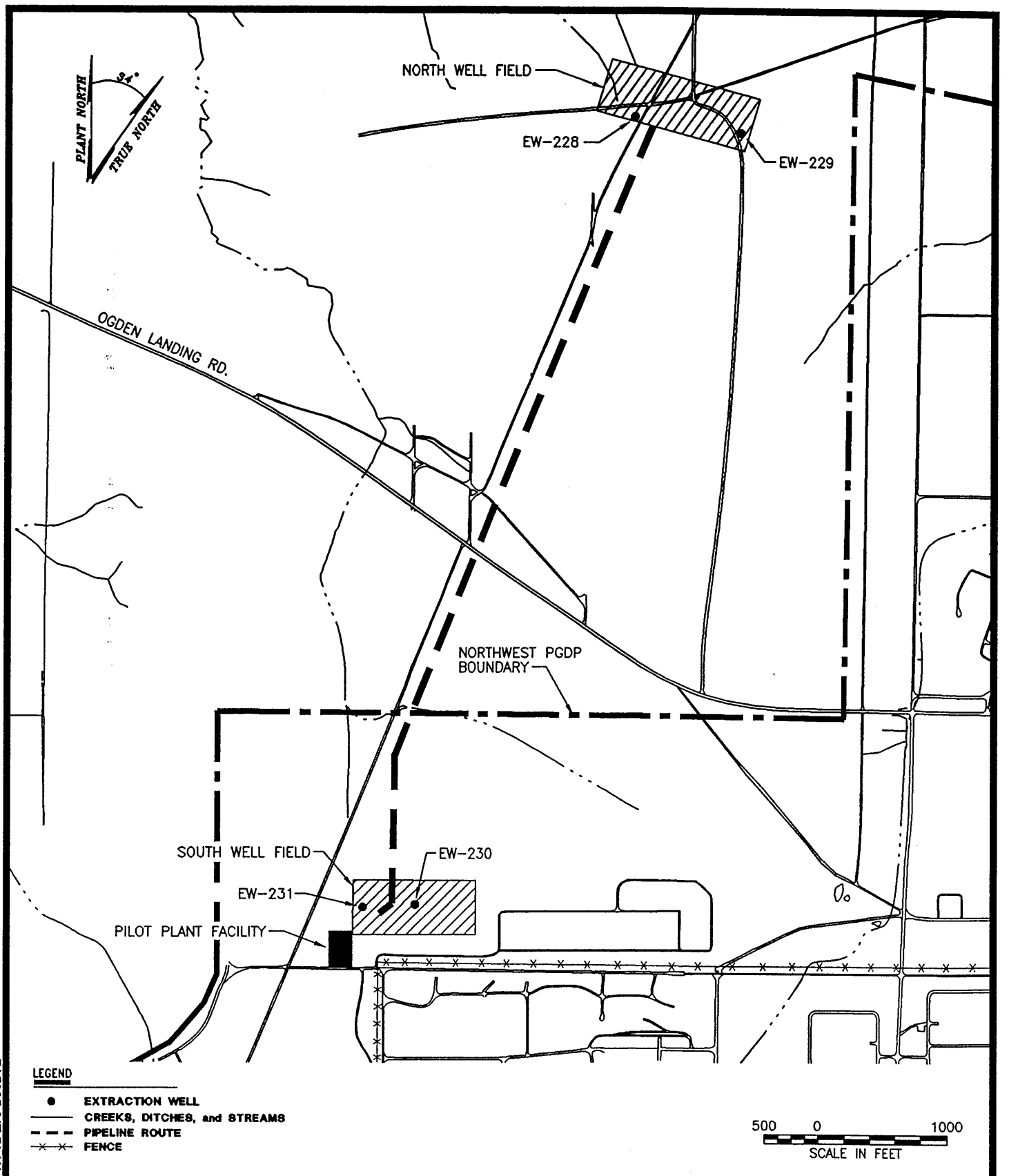

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Fig. 1.1. Location of extraction wells and NWPGS relative to the PGDP.

2. DESCRIPTION OF NORMAL OPERATIONS AND MAINTENANCE

2.1 OPERATIONS AND MAINTENANCE

This section provides operating guidelines and references for the NWPGS and support laboratory. Overviews are presented for conduct of operations, treatment technology, operating procedures, operator checks, system maintenance and calibration, communication, and waste management.

2.2 OVERVIEW OF OPERATIONAL STRATEGY, SYSTEM CONTROL, AND CONDUCT OF OPERATIONS

2.2.1 Operational Strategy

NWPGS operations will be conducted to meet the primary objectives of the NWPGS and Record of Decision (ROD) (DOE 1993a). System operating parameters (such as extraction well flow rates) will be based on treatment system, extraction well, and monitoring well data.

2.2.2 Overall System Control

The NWPGS is an automated system with alarms and interlocks that will shut down the system when certain alarm conditions occur (refer to Sect. 3). The system is designed to operate for brief periods (overnight, weekends) in an unstaffed mode, but is staffed during day shift for maintenance, calibrations, sampling, etc., and as needed during process upsets, flow rate changes, etc. Control of the NWPGS is maintained by locally mounted instruments and controls linked to a main system control panel.

Specific structures, systems, and components identified as being important to overall system integrity are controlled in accordance with the *Configuration Management Plan* [CMP] *for the Northwest Plume Groundwater Treatment System and the Northeast Plume Containment System* (LMES 1997b). The CMP identifies key roles, responsibilities, and interfaces required for the creation of a Change Control Board and establishes a process for change request approval/disapproval, appeal, and change document control.

2.2.3 Conduct of Operations

NWPGS conduct of operations will be performed in accordance with the NWPGS Conduct of Operations Applicability Matrix contained within the NWPGS Reference Manual. Responsibilities and actions that affect the quality of the O&M of the NWPGS are described in detail in the QA/DM Plan (LMES 1997a); this plan is intended to prevent significant quality failures before data generation and to minimize the impact of such failures.

2.3 OVERVIEW OF TREATMENT TECHNOLOGY (PROCESS THEORY)

The two primary treatment technologies used at the NWPGS are air stripping and ion exchange. These process technologies are briefly described below. Process technologies that are secondary to the primary contaminant removal technologies at the NWPGS include suspended solids removal by

filtration, solids dewatering, and gas-phase activated carbon adsorption.

2.3.1 Air Stripping

The NW Plume TCE-contaminated groundwater is pumped from an equalization (EQ) tank through filters for solids removal to the top of the air stripping tower. Air is drawn upward through the tower as the contaminated groundwater flows downward through the system. The countercurrent flow of air and water causes TCE to be stripped from the water and transferred to the air stream. The air stream is then passed through granular, activated carbon to remove TCE before release to the atmosphere.

2.3.2 Ion Exchange

In groundwater at the NW Plume site, ^{99}Tc exists as the pertechnetate ion (TcO_4^-), which can be removed by ion exchange technology. During the first two years of pilot operation, four types of ion exchange resin were evaluated for performance. Based on cost and effectiveness, Purolite A-520-E resin was selected as the preferred resin.

The ^{99}Tc-contaminated groundwater exits the air stripper and enters the ion exchange columns. Ion exchange is carried out in a pressurized vessel that contains a bed of ion exchange resin composed of small spherically shaped beads. As contaminated water flows downward through the resin bed, anions are exchanged for chloride ions on the resin beads. Effluent from the air stripper flows through a header at the top of the vessel, flows downward to a lateral collection assembly at the bottom of the vessel, and exits the ion exchange vessel. Pertechnetate ions passing through the ion exchange bed will be removed until the available exchange sites are filled, after which these ions will begin to "leak" through the ion exchange columns and appear in the effluent stream. This "leaking" is defined as breakthrough. Pertechnetate ions have a greater affinity for some resins than other anions in the groundwater (sulfates, chlorides, nitrates, etc.); thus, pertechnetate ions tend to preferentially adsorb onto the surface of the resin beads (DOE 1993b, Sect. 3.1).

2.4 OPERATING PROCEDURES

The NWPGS is operated in accordance with approved procedures/work instructions, equipment manuals, and sound engineering practices. All procedures/work instructions are provided in the NWPGS Reference Manual. Additional procedures/work instructions will be developed, as necessary, for operation of the NWPGS.

2.5 OPERATOR CHECKS

The Operations Subcontractor will operate the NWPGS, conduct equipment inspections, and record process data to ensure effective and safe system operations. Information such as system flow rates, alarm conditions, tank levels, pump status, pressure readings, and other data will be collected and reviewed regularly. The format and frequency of data collection are included in the NWPGS Operational Data Collection Sheets provided in the NWPGS Reference Manual.

2.6 SYSTEM MAINTENANCE

NWPGS maintenance (corrective and preventive) is performed in accordance with equipment manufacturers' recommendations and sound engineering practices. Detailed information on maintenance activities is included in the NWPGS Calibration and Maintenance Plan located in the NWPGS Reference Manual.

2.7 COMMUNICATION

Current NWPGS communications equipment used by NWPGS personnel is listed below:

- pagers,
- cellular telephones,
- telephone system, and
- two-way radio.

Operators will maintain two forms of communication at all times.

Autodialer

The NWPGS contains a dedicated automatic telephone dialer (autodialer) for calling designated on-call personnel when system alarm conditions occur at the facility.

Abnormal operating conditions trigger alarms in the main control system. The autodialer, upon receipt of an alarm signal from the programmable logic controller (PLC), dials on-call personnel and delivers an alarm message. The NWPGS Operations Subcontractor will notify the Project Manager of all call-outs. If the autodialer is not answered or if the alarm is not properly acknowledged, it continues to dial the programmed numbers in succession until the alarm is properly acknowledged. The autodialer operates over standard telephone equipment.

Emergency telephone numbers for police, fire, medical emergencies, and key NWPGS personnel as well as PGDP interplant emergency lines are provided on the NWPGS Emergency Telephone Listing that is posted near all telephones and is routinely updated, and also are provided in the HSP (Appendix A). Details on NWPGS Communications are provided in the NWPGS Reference Manual.

2.8 WASTE MANAGEMENT

The Waste Management Plan for the NWPGS addresses the management of waste produced at the NWPGS and associated laboratory from the point of generation through transportation off the NWPGS site to a secured storage area within the PGDP fence. The plan was developed in accordance with procedure ERWM/ER-P2101 and is included in the NWPGS Reference Manual.

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3. DESCRIPTION OF POTENTIAL OPERATING EMERGENCIES

This section describes operating emergencies that cause the shutdown of the NWPGS. It is limited to major emergencies and is not all-inclusive.

3.1 CAUSES FOR NWPGS SHUTDOWN

The NWPGS will shut down automatically as the result of certain nonroutine operating conditions. System shutdowns are initiated by programmed system interlocks that respond to the nonroutine operating condition and active system alarms. System alarms are the means by which the PLC communicates with the NWPGS operator. There are numerous alarm conditions; however, the alarms listed in Table 3.1 result in the activation of the NWPGS autodialer and an operator call-out occurs. Table 3.1 lists system conditions and probable cause(s) related to each alarm condition.

Table 3.1. Alarm conditions

Alarm no.	Alarm condition	System condition	Probable cause
1	EQ pump shutdown	Automatic system shutdown has occurred	Extraction well pump(s) shut down because of high/low pressure, high/low current, or a leak detection alarm
2	Sump level high	Automatic system shutdown has occurred	Faulty sump level detector or ruptured or leaking vessels
3	Manhole leak	Automatic shutdown of extraction wells serviced by the alarmed manhole has occurred	Infiltrated groundwater or system pipeline leak
4	High TCE in effluent	System continues to operate until the operator manually shuts it down (if required) when responding to the call-out	TCE concentration in effluent exceeds "set point" or on-line analyzer is operating incorrectly

3.2 RESPONSE AND NOTIFICATION PROCEDURE FOR NWPGS SHUTDOWN

To troubleshoot and correct system problems, personnel will follow appropriate procedures/work instructions and manufacturers' equipment manuals, and seek any necessary outside technical assistance. NWPGS operators will record all shutdown events, actions taken, and other pertinent information. The NEPGS Operations Subcontractor will notify the Project Manager.

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4. DESCRIPTION OF ROUTINE MONITORING AND LABORATORY TESTING

4.1 INTRODUCTION

Groundwater and process monitoring is conducted to ensure proper facility operation and compliance with the *Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant* (DOE 1993a). The data quality objective (DQO) process was used by the NWPGS team to ensure collection of data of appropriate quality and quantity to meet NWPGS and ROD objectives.

4.2 DATA QUALITY OBJECTIVES

4.2.1 Problem Statement

The NWPGS extracts groundwater contaminated with TCE and ^{99}Tc and transfers it to the treatment system located in the C-612 Facility. The treatment system removes TCE by air stripping and ^{99}Tc by ion exchange resin. The treated water is discharged into the Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 001. The objective of the NWPGS is to initiate control of the contamination and mitigate the spread of the highest concentration portion of the NW Plume.

4.2.2 Principal Study Questions, Decision Rules, and Data Needs

Table 4.1 outlines the principal study questions, decision rules, and data needs required to effectively monitor the operations of the NWPGS and meet the objectives stated in the ROD.

4.3 NWPGS WELL FIELD

The NWPGS well field is comprised of four extraction wells (EW) and 18 monitoring wells (MW), which are EW-228, EW-229, EW-230, EW-231, MW-233, MW-234, MW-235, MW-236, MW-237, MW-238, MW-239, MW-240, MW-241, MW-242, MW-243, MW-244, MW-245, MW-246, MW-247, MW-248, MW-249, and MW-250 and shown in Fig. 4.1.

Eleven additional wells are monitored to evaluate groundwater flow direction and changes in plume configuration and migration. They are MW-63, MW-66, MW-98, MW-123, MW-134, MW-135, MW-185, MW-197, MW-200, MW-201, and MW-202.

Table 4.1. Principal study questions, decision rules, and data needs

Question/goal	Decision rule	Data needs
1. Are we mitigating the spread of the plume and initiating control of the source?	If field data from the NWPGS well field and mathematical modeling of the plume indicate that NWPGS system is not initiating control of the source of contamination and mitigating the spread of the highest TCE concentration portions of the NW Plume, then NWPGS operations will be evaluated and appropriate actions will be taken.	Field data will be collected from the NWPGS well field.[a]
2. Are we effectively meeting operational goals of 5 ppb or less TCE and 900 pCi/L or less ^{99}Tc discharging from C-612?	If levels of TCE exceed 5 ppb or levels of ^{99}Tc exceed 900 pCi/L, then NWPGS operations will be evaluated and appropriate actions will be taken.	TCE and ^{99}Tc samples will be collected from the NWPGS effluent (HV-171).
3. Are we satisfying the regulatory limit of 81 ppb or less for TCE at Outfall 001?	If 81 ppb TCE is detected at the C-612 effluent, then operations will be shut down, the system will be evaluated, and the appropriate actions taken.	TCE samples will be collected at HV-171.
4. What levels of TCE are being discharged into the atmosphere?	If the NWPGS exceeds its allocated portion of TCE emissions for environmental restoration activities, NWPGS operations will be evaluated and appropriate actions will be taken.	TCE samples will be collected from the NWPGS influent (HV-82), air stripper effluent (AHV-014), and effluent (HV-171). Mass balance calculations will be performed using the above data.
5. What levels of ^{99}Tc are we discharging to the atmosphere?	These data are required to be collected for annual NESHAPs calculations.	^{99}Tc samples will be collected from the NWPGS influent (HV-82), air stripper effluent (HV-014), and effluent (HV-171).
6. Are we meeting the requirements stated in the Facility and Nuclear Safety evaluation?	If TCE or ^{99}Tc levels, flow rates, or operating system conditions exceed levels or change from the current safety evaluation, then immediate action will be taken followed by a system evaluation and other appropriate actions.	TCE and ^{99}Tc samples will be collected from the NWPGS influent (HV-82). Daily NWPGS flow rates will be calculated from operational data.

Table 4.1 (continued)

Question/goal	Decision rule	Data needs
7. Is the system running efficiently?	If system components are not operating within the manufacturers' specified performance criteria, then system operations will be evaluated and maintenance performed. Otherwise, operation of the NWPGS will continue as outlined.	Operational data (such as flow rates, pressure readings, and tank levels) will be collected. Operational samples will be collected and analyzed. The collected data will be reviewed to determine system performance. Details on operational data collection and operational samples will be included in the NWPGS Reference Manual.
8. What groundwater volumes/flow rates are we extracting from the NWPGS extraction wells?	If the daily withdrawal volume exceeds 432,000 gal, then the NWPGS system flow rate will be adjusted below this level.	Pumping volumes and flow rates will be recorded on a daily basis, excluding holidays and weekends, from each of the operating NWPGS extraction wells.
9. Is waste properly characterized for storage and/or disposal?	If waste is not properly characterized for storage and/or disposal, then additional sampling and analyses will be performed.	Data will be collected in accordance with PWMW-1002 "On-site Handling and Disposal of Waste Materials."

[a]Monitoring well groundwater sampling will be performed under the groundwater monitoring program. Frequencies and analytes are as follows:

Every sampling event – depth to water, dissolved oxygen, pH, specific conductance, temperature.

Quarterly parameters – depth to water, dissolved oxygen, pH, barometric pressure reading, specific conductance, temperature, turbidity, volatile scan, ^{99}Tc, radon-222, gross alpha and beta, calcium, potassium, magnesium, sodium, chloride, fluoride, nitrate-nitrogen, phosphate-phosphorous, sulfate, alkalinity (P&M), total and dissolved metals (aluminum, iron, and manganese), and silica.

Annual parameters – total uranium, total and dissolved metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc), total organic carbon, and total dissolved solids measured during the first quarter of each year.

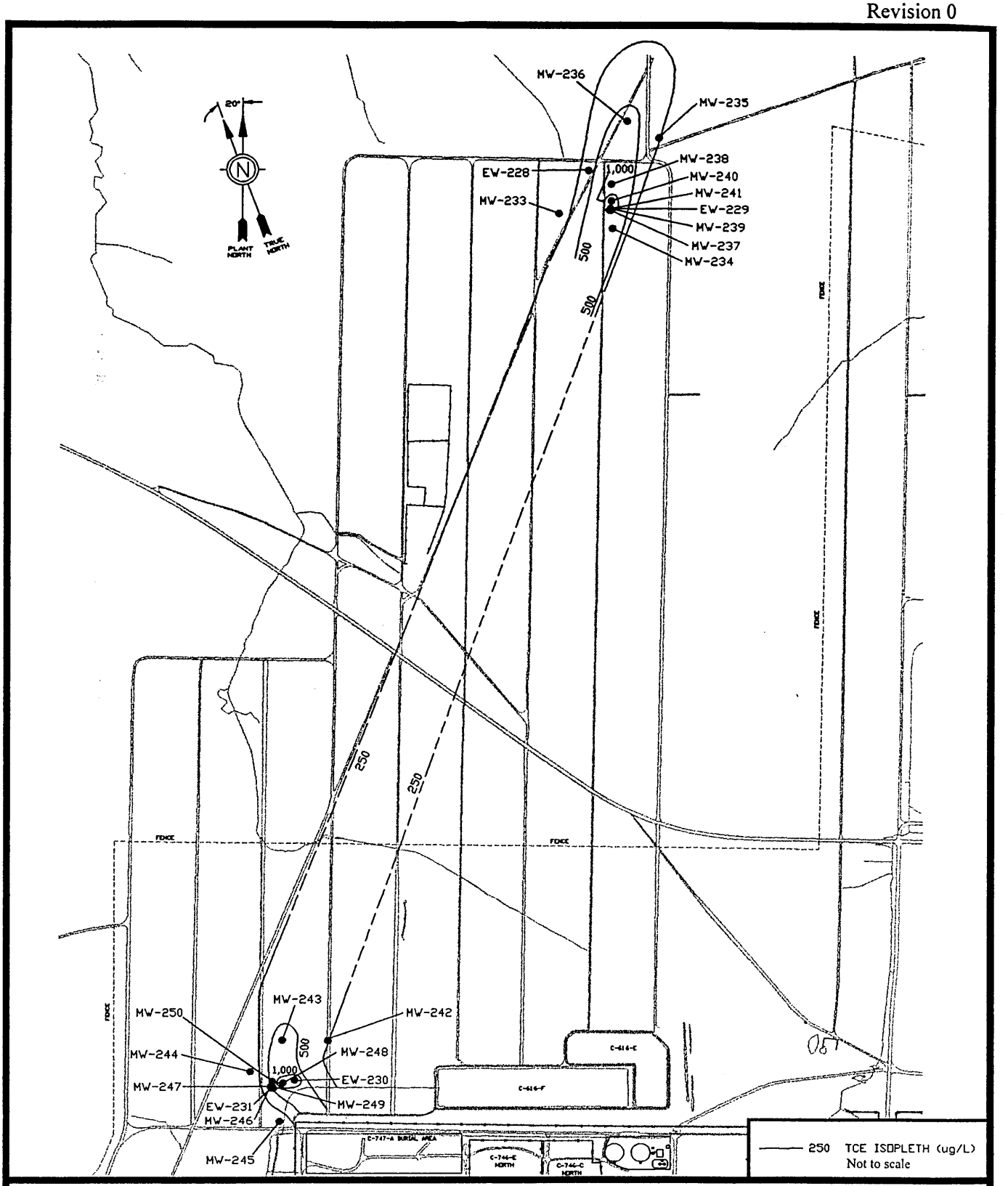

Fig. 4.1. NWPGS well field map.

4.4 SAMPLING, ANALYSIS, AND DATA COLLECTION

Numerous types of data are collected to support operations at the NWPGS. To ensure that all DQOs are met, a summary table of sampling, analysis, and data collection was formulated and is presented in Table 4.2. Additional sampling and analysis information required to meet DQOs is provided in the Sampling and Analysis and Quality Assurance Plan located in the NWPGS Reference Manual. Sampling will be performed by the Operations Contractor, unless otherwise noted.

4.4.1 Quality Assurance and Quality Control

Information pertaining to quality assurance (QA)/quality control (QC) such as equipment calibration and maintenance for the NWPGS and laboratory, specific sampling and analytical procedures, change control, personnel responsibilities, training, and corrective actions are discussed in the *Paducah Gaseous Diffusion Plant Environmental Management and Enrichment Facilities Quality Assurance Program Plan* (LMES 1996c); *Lockheed Martin Utility Services, Inc. Analytical Laboratory Quality Assurance Program Description* (LMUS 1995); applicable procedures; *Field Laboratory Quality Assurance Plan* (LMES 1996b), and the QA/DM Plan (LMES 1997a).

4.4.2 Sampling and Analysis

NWPGS analytical data consist of both field screening data (previously QC Level II), provided by the on-site laboratory, and definitive data (previously QC Level III), provided by the off-site laboratory. Analyses of TCE and analyses of all other analytes to satisfy the decision rules are performed using the modified U.S. Environmental Protection Agency (EPA) SW-846 methods as described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA 1994). Analyses of ^{99}Tc are performed using a liquid scintillation counter. Specific sampling parameters and requirements are provided in the NWPGS Reference Manual and in the QA/DM Plan (LMES 1997a).

Specific QC samples are collected to monitor the effectiveness of the sampling procedures and laboratory methods. QC samples are collected, as needed, for this project. They include field blanks, duplicate samples, equipment rinseates, and trip blanks. Additional information is provided in the QA/DM Plan (LMES 1997a).

4.4.3 Data Review

The data review process consists of the verification, validation, and assessment of the environmental measurements data and analytical results received from laboratory and field measurements taken. Data verification is performed on all analytical data to determine if the number of samples, analytical and field methods, parameters, and other requirements are met. The data validation process determines whether proper QC methods are used and whether the results meet established QC criteria. Data verification, validation of off-site laboratory data, and assessment will be performed according to procedure PMSA-1001, "Quality Assured Data." Verification of 100% of on-site laboratory data is performed by NWPGS personnel.

Table 4.2. Summary of sampling, analysis, and data collection

Sample point(s)	Parameters	Frequency	Decision rule
NWPGS well field[a]	Routine groundwater monitoring parameters[b]	Quarterly[b,c] and annually[b]	1
System influent (HV-082)	TCE	Weekly[f]	4, 6
	^{99}Tc	Weekly	4, 5, 6
	Si, Fe, Mn	Monthly[g]	[d]
System effluent (HV-171)	TCE	Daily[e]	2, 3, 4
	^{99}Tc	Daily	2, 4, 5
Air stripper effluent (HV-014)	^{99}Tc	Monthly	5
System Ion Exchange Units[h]	^{99}Tc	Bimonthly	[d]
Operational data	Multiple[i]	Daily and weekly	6, 7
KPDES Outfall 001[j]	KPDES permit list	Monthly	3

[a]See the list of wells in Sect. 4.3.
[b]Sampling parameters and frequencies are provided in Table 4.1.
[c]Quarterly – one sample every 3 months, with samples no more than 4 months apart.
[d]These samples are necessary for operational control.
[e]Daily samples – daily refers to normally manned operations, which excludes weekends and holidays.
[f]Weekly – one sample per calendar week.
[g]Monthly – one sample per calendar month.
[h]Samples will be collected from each lead column (two columns are in the lead position).
[i]Operational data collection parameters include pressure, flow rates, tank levels, and others. For details refer to the NWPGS Reference Manual.
[j]KPDES samples are not collected or analyzed as part of the NWPGS project.

The Project Manager may temporarily increase sampling to support operational troubleshooting. Sampling will be temporarily suspended when the facility is shut down or other operational conditions exist that would make sampling impractical.

4.4.4 Corrective Action Procedures

Project personnel are responsible for identifying conditions adverse to quality and informing the Project Manager. Corrective action procedures require that conditions adverse to quality be identified and documented, and corrective action be taken and verified in accordance with Procedure QA-312, "Issues Management Program," and the QA/DM Plan (LMES 1997a).

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5. DESCRIPTION OF ALTERNATE OPERATIONS AND MAINTENANCE

The NWPGS is designed to operate 7 days per week and 24 hours per day. Shutdowns of the NWPGS will be addressed in the quickest possible manner to ensure minimum downtime and prevent adverse effects on equipment. System program interlocks, mechanical protection devices (e.g., pressure relief valves), and the autodialer help protect against equipment damage and promote worker safety. Manufacturers' reference manuals, work plans, guidance documents (e.g., HSP, Conduct of Operations Applicability Matrix), and procedures/work instructions provide guidance to NWPGS personnel so that operations will be conducted safely and efficiently. Because temporary shutdown of the NWPGS does not endanger workers, the public, or the environment, an alternate O&M Plan is not necessary.

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6. SAFETY PLAN

An HSP was developed for the NWPGS using pertinent information about the site, potential contaminants and hazards that may be encountered, and hazards inherent to routine activities performed during NWPGS operations. The HSP is provided in Appendix A.

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7. DESCRIPTION OF EQUIPMENT

This section describes equipment associated with the NWPGS, including monitoring components, as well as equipment maintenance and replacement. Figure 7.1 presents a schematic of the groundwater treatment system, including all major components.

7.1 EQUIPMENT IDENTIFICATION

The NWPGS is composed of several operating systems that are described in detail in the NWPGS Reference Manual. These systems include the following:

- groundwater extraction wells, well pumps, and pipeline system;
- EQ pump and tank;
- pretreatment and filter system;
- air stripper and vapor-phase carbon system;
- ion exchange and resin dewatering system;
- backwash supply and treated water discharge system;
- compressed air system;
- instrument and control systems; and
- sump and building systems.

As shown in Fig. 1.1, groundwater from the extraction wells is transferred through a pipeline to the NWPGS. Groundwater from the north and south well fields is combined in the EQ tank and pumped through the filters before being discharged at the top of the air stripper for TCE removal (see Fig. 7.1). Vapors from the air stripper are passed through granular, activated carbon for TCE removal before release to the atmosphere. Liquids exiting the air stripper enter ion exchange columns for ^{99}Tc removal before being discharged to KPDES Outfall 001.

7.2 INSTALLATION OF MONITORING COMPONENTS

There are nine secured manhole monitoring stations, with leak detection probes, located along the north and south pipeline headers. Should a leak occur, an alarm signal will be displayed at the main system control panel and the corresponding extraction well pumps will shut down automatically.

Local control panels for system monitoring are located at each extraction well, the filters skid, and the air stripper skid. Each extraction well pump has a flowmeter/totalizer, pressure gauge, and HIGH and LOW pressure switches that will cause the pump to shut down at pre-set pressures. Additionally, the PLC will shut down the pump when manually prompted by the operator, when the EQ tank level is high, or when a leak is detected in the pipeline. After shutdown, the pump(s) can be manually restarted at the main system control panel only after all alarm conditions have been cleared. The main system control panel is located inside the NWPGS building and has a system descriptive graphic display, an operator interface unit, and a PLC. The system descriptive graphic shows the north and south well pipeline with current status on all pumps and manholes.

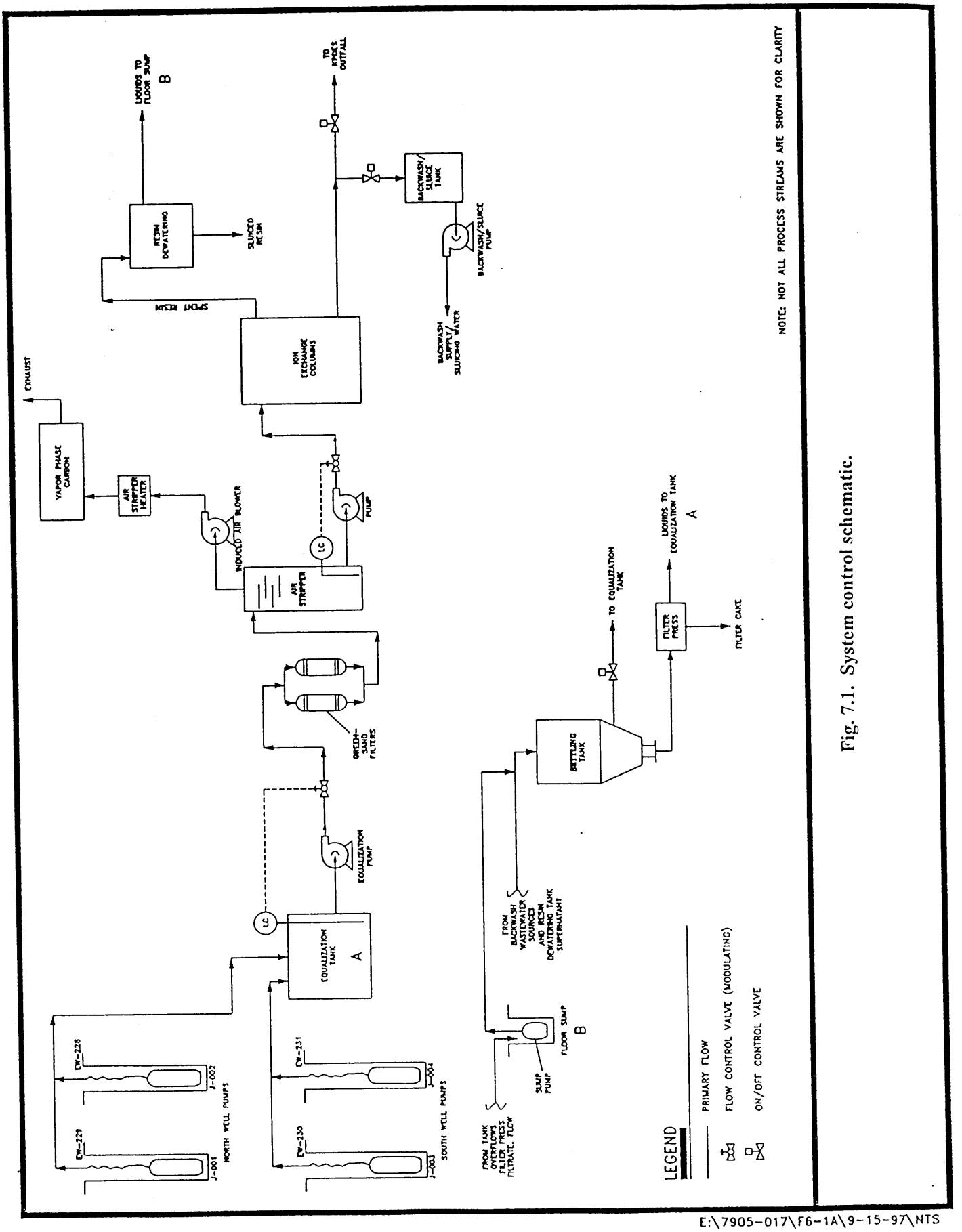

Fig. 7.1. System control schematic.

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The EQ tank effluent pump is a horizontal, centrifugal, electric-driven pump that pumps untreated groundwater through the filters to the air stripping tower. The pump discharge line has a pressure gauge and an automatic control valve that regulates flow in the discharge line. The control valve is monitored by the PLC and is automatically adjusted to maintain a constant level in the EQ tank. The PLC is programmed to automatically shut down the system if the EQ tank level is too high or too low. A flow detector measures effluent flow from the EQ tank in total gallons and instantaneous gallons per minute. Because a constant level is maintained in the EQ tank, this flow rate also represents the total system effluent flow.

7.3 MAINTENANCE OF SITE EQUIPMENT

Equipment replacement, calibration, and maintenance are performed in accordance with the manufacturers' recommendations. Detailed information on required maintenance and calibration activities are included in the NWPGS Calibration and Maintenance Plan located in the NWPGS Reference Manual.

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8. RECORDS AND REPORTING

8.1 RECORDS AND LABORATORY LOGBOOKS

Documents and records are transferred to and archived at the ER Document Management Center (DMC). Records documenting significant information involved with the NWPGS also are maintained by NWPGS personnel. Information includes routine operation, unusual occurrences, equipment malfunctions, spills, sampling events, visitors on-site, etc. Operations records, maintenance records, and training records are also kept. Laboratory records are kept, as required, in the appropriate laboratory logbooks and laboratory forms at the on-site laboratory.

8.2 DATA MANAGEMENT

To meet regulatory requirements for the acquisition of technically and legally defensible data, a traceable audit trail is established from the development of sampling through the archiving of information at the ER DMC and in accordance with the QA/DM Plan (LMES 1997a). This necessitates that each step or variation of the sampling and analytical process is documented. Standardized formats for electronic transfer and reporting are performed according to Intersite Procedure EM&EF-P2214, "Environmental Data Entry, Transfer, and Transformation Verification." To meet this requirement, the appropriate management process is followed throughout the collection, management, storage, and analysis of the site environmental characterization data in accordance with the *Environmental Data Management Implementation Handbook for the Environmental Restoration Program* (LMES 1996a).

8.3 PROGRAM REPORTING REQUIREMENTS

Routine O&M of the NWPGS will include preparation of various operations and progress reports for submittal to EPA Region IV and the Kentucky Department for Environmental Protection (KDEP) by the U.S. Department of Energy (DOE). In addition, various components of the NWPGS operation may require preparation of special work plans or reports. This section provides a description of reporting requirements and an estimated schedule for report submission.

8.3.1 NWPGS O&M Plan

This O&M Plan provides the NWPGS operators with background information, reporting requirements, and O&M requirements and guidelines. It also includes references to plans and procedures contained in the NWPGS Reference Manual that aid in maintaining compliance with DOE, EPA, and KDEP policies and statutes. Training requirements and PGDP emergency response and operating procedures also are referenced. It should be emphasized that the O&M Plan is a dynamic document. Modifications and improvements to the O&M Plan, NWPGS procedures/work instructions, and the NWPGS Reference Manual will continue as methods are identified that improve the overall performance and efficiency of system operations or in the event objectives for the interim remedial action for the NW Plume change.

8.3.2 Process Change Reports

During routine operation of the NWPGS, it may become necessary to change certain operation parameters or system configuration. Changes may be required or recommended to enhance system performance or increase system efficiency. Changes also may be necessary to address technical or maintenance issues that develop. Changes involving system configuration will be made in accordance with the CMP (LMES 1997b). However, facility or equipment modifications will not be made without the advance approval of the Project Manager. Facility or equipment changes will be reported to KDEP and EPA in the quarterly report. Process changes also will be summarized in the quarterly report. Approval from KDEP and EPA for major changes to plant operations, such as discontinuing use of major operational systems including the ion exchange columns, the air stripper, and the vapor-phase carbon adsorption columns, or discontinuing effluent discharge to KPDES Outfall 001, will be obtained before implementation.

8.3.3 Quarterly Reports

Quarterly reports will be prepared and issued to DOE within 30 days of the end of the quarter, summarizing the data generated by activities associated with the NWPGS. DOE will subsequently submit quarterly progress reports to KDEP and EPA.

8.3.4 Annual Reports

An annual report was prepared and issued following the first year of operation. The second annual report for the second year of operation was issued in December 1997. Annual reports were submitted to KDEP and EPA. Additional annual reports are not planned.

8.4 EMERGENCY PROCEDURES AND NOTIFICATIONS

The *C-612 & C-614 Groundwater Treatment Systems Emergency Plan* (LMES 1997c) provides guidance on emergency procedures and notification. The plan will be reviewed annually and made available for inspection by NWPGS personnel and oversight organizations having relevant responsibilities. The plan addresses:

- pre-emergency planning;
- personnel roles, lines of authority, and communication;
- emergency recognition and prevention;
- safe distances and places of refuge;
- site security and control;
- evacuation routes and procedures;
- emergency medical treatment and first aid;
- emergency alerting and response procedures;
- critique of response and follow-up; and
- personal protective equipment (PPE) and emergency equipment.

8.4.1 Existing Programs

The PGDP has a comprehensive program for emergency response. In the area of emergency response procedures, the NWPGS is considered a part of PGDP. Personnel are trained during the PGDP site training to report emergencies. All emergencies are to be immediately reported to the Plant

Shift Superintendent's Office using the fastest route possible. This could be a telephone call (441-3333); a radio network call (Alpha 1 on PGDP Radio), or an emergency call box activation (if possible, person will remain in the area to direct the responders).

Agreements are in place and will be maintained, dictating that PGDP emergency response personnel will handle requests for assistance from the NWPGS. NWPGS personnel will cooperate with emergency response personnel and the SSHO. They may be asked to provide assistance in accounting for personnel, gathering at the safe refuge point, and reporting the status of the incident.

The SSHO will possess a two-way radio to maintain communication with the NWPGS Operations Manager during emergency response situations. The SSHO is responsible for management of emergency response activities until the PGDP Emergency Squad arrives on-site.

The SSHO will be knowledgeable of the PGDP emergency reporting procedures. The SSHO will seek immediate medical attention and notify the NWPGS Project Manager in the case of an accident or medical emergency. The SSHO will also assist the NWPGS Project Manager in investigating and documenting accidents.

8.4.2 Accident/Incident Reporting

All NWPGS personnel are required to immediately report any injury, regardless of severity, to their supervisor in accordance with the *C-612 & C-614 Groundwater Treatment Systems Emergency Plan* (LMES 1997c). Once informed, the supervisor will report the incident to the SSHO, who will make necessary notifications. In the event of a serious injury, personnel may seek immediate emergency medical assistance before notifying their supervisor.

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9. OPERATIONS AND MAINTENANCE COST ESTIMATE

The estimated annual operating cost of the NWPGS for FY 1998 is $1,818,000. This cost is a total project cost which includes, but is not limited to, operations and maintenance of the system, sampling, laboratory analysis, data validation, preparation of progress reports, and financial reporting on the project. Also included are costs associated with the DOE Technical Support contractor for fate and transport modeling of plume containment evaluation and regulatory document preparation such as the ROD review and water policy review.

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10. REFERENCES

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EPA (U.S. Environmental Protection Agency) 1994. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846, 3rd Edition.

LMES (Lockheed Martin Energy Systems, Inc.) 1996a. *Environmental Data Management Implementation Handbook for the Environmental Restoration Program.* ES/ER/TM-88/R1.

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LMES (Lockheed Martin Energy Systems, Inc.) 1997b. *Configuration Management Plan for the Northwest Plume Groundwater Treatment System and the Northeast Plume Containment System.* KY/EM-194.

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APPENDIX A

GENERAL OPERATIONAL HEALTH AND SAFETY PLAN

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A. GENERAL OPERATIONAL HEALTH AND SAFETY PLAN

A.1 INTRODUCTION

This Health and Safety Plan (HSP) was developed for the Paducah Gaseous Diffusion Plant (PGDP) Northwest (NW) Plume Interim Remedial Action Operations and Maintenance (O&M) Plan, using general information about the site, potential contaminants and hazards that may be encountered at the site, and hazards inherent to routine procedures to be used during Northwest Plume Groundwater System (NWPGS) operation. This HSP covers health and safety-related issues pertaining to the NWPGS facility.

If conditions exist such that a revision is necessary, revisions will be made by the Site Safety and Health Officer (SSHO) and approved by the Health and Safety Manager.

A.2 HAZARD COMMUNICATION AND TRAINING

A.2.1 Hazard Communication

Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.1200, "Hazard Communication Standard," requires that employees handling or using materials that may be hazardous, be advised and informed as to the hazard potential associated with those materials. A copy of the Hazard Communication Program is available at the Command Media Center located in C-612-T-02. This training will be documented and additional information will be conveyed through the following:

Material Safety Data Sheets (MSDS). An MSDS is an information sheet that provides specific material identification information; ingredients and hazards; physical data; fire and explosion information; reactivity data; health hazard information; spill, risk, and disposal procedures; special protection information; and special precautions required for materials manufactured for use. It is the manufacturers' responsibility to provide this information for any materials that contain hazardous or potentially hazardous ingredients.

Copies of MSDSs for materials expected to be used or encountered during project work are to be available at the Command Media Center located in C-612-T-02. Each employee is to be made aware that these MSDSs exist and are available.

Labels. It is the responsibility of the SSHO to ensure that potentially hazardous materials brought to the NWPGS are properly labeled as to the contents of the container and the appropriate hazard warnings in accordance with OSHA 24 CFR 1910.1200.

A.2.2 Chemical Inventory

Chemicals will be placed in the chemical staging area at C-612-T-01 before use if they have not been approved. However, the chemical is already considered approved if its MSDS is in the chemical inventory records. Chemical inventories are conducted monthly.

A.2.3 Training

Hazardous Waste Worker Training. NWPGS personnel who regularly perform work inside the NWPGS facility will be required to have successfully completed the initial 40-hour Hazardous Waste Site Operations training, including required annual updates.

First Aid/CPR. NWPGS personnel and sampling crews will have at least one individual trained in first aid/CPR.

PGDP Required Training. NWPGS personnel (whose work assignment is the NWPGS or who are required to be on-site on a regular basis) will be required to attend the following PGDP site-specific training provided by the Facility Manager.

- Lockout/Tagout
- General Employee Training
- Safety and Health Work Permit
- General Employee Radiological Training
- Security Orientation
- Waste Generator
- General Nuclear Criticality Safety
- RAD Worker II
- Fire Watch (only for personnel performing fire watch duties)

The Facility Manager will identify any additional training requirements as required.

A.3 MEDICAL SURVEILLANCE

Employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limit (PEL) and employees who wear a respirator for 30 days or more per year will receive a medical examination before assignment, and at least once every 12 months thereafter (unless a longer interval not to exceed biannually is deemed appropriate by the attending physician), and at termination of employment or reassignment. Employees who develop signs or symptoms indicating exposure or who are injured or exposed above the PEL in an emergency situation will be medically examined as soon as possible following the incident.

A.4 SPILL CONTAINMENT

In the event of a spill during the off-shift or the potential of a spill leaving the NWPGS, NWPGS personnel will immediately contact the PGDP Shift Superintendent followed by the Health and Safety Manager or the SSHO. On-site personnel will then locate the source and stop the spillage if it can be done safely and will begin containment and recovery of spilled material using the current spill and leak emergency response procedure or work instruction. It will be the responsibility of the SSHO to maintain the site emergency equipment (i.e., spill kits) in good working order.

Plant and Local Emergency Signals. Plant and local emergency signals and their descriptions are shown in Table A.1. Personnel should be familiar with these and know the proper action to take. The Fire and Emergency Response Plan for PGDP has been provided to the local fire department and other emergency response agencies.

A.5 HEAT/COLD STRESS

The most common types of stress that affect field personnel are heat stress and cold stress. In light of this, employees will understand the signs and symptoms of potential injuries associated with working in temperature extremes.

A.6 FALL PROTECTION AND FALL PREVENTION

In order to protect personnel from injury during elevated work activities, the following fall protection and fall prevention practices will be enforced.

A.6.1 PGDP Fall Protection Policy

PGDP fall protection will be maintained when working 6 ft or more above the surface or whenever objects closer than 6 ft present a danger from striking as a result of a fall. Fall protection and fall prevention will consist of one or more of the following:

1. preventing a fall by installing adequate guard rails;

2. restricting entry into a fall hazard area by use of barricades, barriers, or warning flagging; or

3. protecting the employee by using fall protection equipment (full body harness, shock-absorbing lanyards, and single/twin lanyards) to arrest a fall.

A.6.2 Fall Arrest Equipment

1. A full body harness and lanyard are required when working 6 ft or more above a protected area or less if there is a danger of contacting objects as a result of a fall.

2. Single/twin lanyard systems will be used if at any time the individual must unhook a lanyard for movement while wearing fall protection.

3. Full body harnesses will be Class C, approved by the American National Standards Institute (ANSI).

4. Lanyards will be shock absorbing and have double-locking hooks that prevent roll-out.

Table A.1. Plant and local emergency signals

THE ATTACK WARNING	Intermittent 2-second blast on plant horns	This sound means an air attack or tornado is imminent. When you hear this, take cover in the nearest take-cover area.
THE ALERT SIGNAL	Continuous blast on plant horns	The alert signal means that possible emergency conditions exist. Evacuate the building and follow directions given over the plant public address system.
THE EMERGENCY RADIATION SIGNAL	Continuous blast on special high-pitched whistle	Upon hearing this sound, rapidly leave the area and report immediately to your designated assembly point.
CASCADE BUILDINGS LOCAL ALARMS	Three blasts on building horns or howlers	Upon hearing three blasts on building horns, contact or report to your designated control room.
BUILDING EVACUATION C-100, C-360, C-710, AND C-720	Continuous blast on building horns	This sound means evacuate the building and follow instructions of the plant emergency director as given over the plant public address system.
THE C-720 LOCAL EMERGENCY SQUAD	One 10-second blast on building siren	This sound calls for the assembly of the C-720 local emergency squad.
THE COMMUNITY WARNING SIREN	Continuous wail on off-site sirens	This sound indicates a condition at this facility that may affect both the plant and surrounding community. It currently means to shelter in-place and listen to your Emergency Broadcast System for further instructions.

5. Personnel on unprotected elevations will be tied off to lifelines attached to structures capable of supporting at least 5400 lb dead weight per employee.

6. Fall protection equipment will be inspected before each use. Lanyards and harnesses will not be used if evidence of damage is present. Hardware must be examined and worn parts replaced.

7. Harnesses and lanyards must be removed from service if used in a fall.

A.6.3 Ladder Inspection and Use

1. Ladders with broken or missing rungs or steps, broken or split rails, or other faulty or defective construction will be tagged "Defective Do Not Use" and will be removed from the job site.

2. Extension ladders will be tied, blocked, or otherwise secured to prevent them from being displaced.

3. Ladders will be placed on a firm, level base, and the area around the top and bottom of the ladders will be kept clear.

4. When ladders are used for access to platforms or working surfaces, the side rails will extend at least 3 ft above the landing.

5. Always face a ladder when ascending or descending.

6. Always have free use of both hands and feet to firmly grasp the ladder while ascending or descending ladders. Such free use of the hands will preclude the use of fall protection during ascending or descending only.

A.6.4 Working Surfaces

1. Places of employment, passageways, storerooms, and service areas will be kept clean and orderly and in a sanitary condition. The floor of every work area will be maintained in a clean and, so far as possible, dry condition. To facilitate cleaning, every floor of every working place and passageway will be kept free of protruding nails, splinters, holes, or loose boards. Aisles and passageways will be kept in good repair with no obstruction that could create a hazard.

2. Every open-sided floor or platform 6 ft or more above adjacent floor or ground level will be guarded by a standard railing or the equivalent on open sides, except where there is entrance to a ramp, stairway, or fixed ladder. The railing will be provided with a standard toeboard whenever persons can pass beneath the open sides, or there is moving machinery, or there is equipment with which falling material could create a hazard.

3. A stairway or ladder will be provided at personnel points of access where there is a break in elevation of 19 in. or more, and no ramp, runway, sloped embankment, or personnel hoist is provided.

4. At no time will employees be allowed to climb the mast of a drill rig while it is in the upright position.

A.6.5 Aerial Lifts

1. Aerial lifts will not be modified for uses other than those intended by the manufacturer, unless the modification has been certified in writing by the manufacturer.

2. Aerial lift operators will be trained to the manufacturer's operating instructions.

3. The manufacturer's recommended checkout instructions (or equivalent) will be completed daily by the operator before use.

4. Personnel will remain in the platform or bucket at times and will not use the platform to gain access to a work location.

5. The load limits specified by the manufacturer will be posted on the equipment and will not be exceeded.

6. An aerial lift will not be used as a material hoist.

7. A full body harness must be worn with the lanyard attached to the platform anchorage point while in the platform or bucket.

A.6.6 Training

Personnel who may be exposed to a fall hazard during their work duties will be trained in fall protection and fall prevention before starting those duties on-site.

A.7 HOISTING/RIGGING PRACTICES

In order to ensure that personnel and equipment are not injured or damaged during hoisting and rigging operations, safe working guidelines will be enforced.

Hoisting and rigging activities will be reviewed by the SSHO to determine their classification. Hoisting and rigging activities will comply with the U.S. Department of Energy (DOE) Hoisting and Rigging Manual.

Rigging equipment for material handling will be visually inspected before use on each shift by the SSHO and as necessary during its use to ensure that it is safe. Defective rigging equipment will be removed from service and repaired and/or destroyed. Rigging will comply with the DOE Hoisting and Rigging Manual.

A.8 CONFINED SPACE ENTRY

Confined space entries will follow 29 CFR 1910.146, DOE Orders, and applicable procedures or work instructions. Before entry into a confined space, the most current procedure will need to be reviewed for adherence by the service supervisor. The most current edition of the Confined Space procedure will be available in the Command Media Center established in C-612-T-02. In addition, applicable permits, communication methods, monitoring requirements, training, and other requirements outlined in this procedure must be met before any confined space entry.

A.9 LOCKOUT/TAGOUT

To ensure the safety of personnel working on equipment or systems, PGDP safe practices and procedures will be followed for lockout/tagout. The purpose of these procedures is to prevent the release of potentially hazardous energy during maintenance or service activities. Lockout/tagout procedures apply to energy sources that could cause injury to personnel from the unexpected energization or release of stored energy while participating in such activities as—but not limited to—installing, constructing, repairing, adjusting, inspecting, testing, or maintaining systems or equipment. The procedures apply to forms of potentially hazardous energy, both latent and residual, including electrical, hydraulic, pneumatic, mechanical, chemical, and radioactive. These procedures will apply to O&M activities conducted in association with the NWPGS.

A.9.1 Responsibilities

The SSHO will be responsible for reviewing needed maintenance or service job requirements and for recognizing the type and magnitude of potentially hazardous energy available in the NWPGS and

associated equipment. The SSHO or any other person performing services associated with O&M of the NWPGS is responsible for shutdown of equipment according to PGDP procedures to maintain a safe working area. The SSHO must be notified immediately of any equipment that has been shut down by other personnel. Documentation of lockout/tagout activities will be maintained in the project file.

A.9.2 Out-of-Service Tags

Out-of-service tags are **not for** use as **employee protection** devices. These tags are for equipment protection or equipment that is inoperable.

A.10 EQUIPMENT INSPECTIONS

Power equipment that is brought to the NWPGS will need to undergo a staging area inspection. This inspection will be conducted monthly by the SSHO or designee. Additionally, equipment and tools will be examined before use.

A.11 RADIATION

A.11.1 Dosimeters

Dosimeters will be worn at times in areas controlled for radiological purposes and when required by signs, work permits, or Radiological Control personnel. These monitors will be received from and delivered to the Facility Manager for analysis. Dosimeters must be worn on the chest area between the waist and the neck. If a dosimeter is lost or misplaced while in an area controlled for radiological purposes, the following steps will be taken.

1. Place work area in a safe condition.
2. Alert others.
3. Immediately exit the area.
4. Notify Radiological Control personnel.

A.11.2 Biological Monitoring Program

Personnel will participate in this monitoring program in accordance with Sect. A.3 of this HSP. Bioassay testing may be conducted when required by a Radiation Work Permit or Health Physics.

A.12 COMMUNICATIONS

Two forms of communication will be available, and the "buddy system" will be used when working in remote areas (see Sect. 2.7).

A.13 OPERATOR'S HEALTH AND SAFETY PLAN FORM

The form will be used by field personnel as a reference guide to health and safety. The operator's HSP form is located in the NWPGS Reference Manual and describes health and safety related issues pertaining to the NWPGS, including the following:

- general descriptions of the site, tasks, contaminants, and concentrations;
- primary and contingency personal protection;
- monitoring equipment and action levels;
- personnel and equipment decontamination; and
- emergency contacts.

If conditions exist such that a revision is necessary, revisions will be made by the SSHO and approved by the Health and Safety Manager.